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GERHARD ERKER ET AL :

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US PATENT 6,002,032

ISSUED: December 14, 1999 : EXAMINER:

FOR: TRANSITION METAL
COMPOUND :

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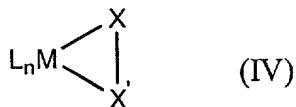
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PRELIMINARY AMENDMENT AND SUBMISSION

Sir:

Please add the following new claims:

- - 22. A transition metal compound of the formula IV



wherein

L are identical or different and are each a substituted π ligand,

n is equal to 1, 2, 3, or 4,

M is a metal atom of group IIIb, IVb, Vb or VIb of the Periodic Table of the Elements.

X is a heteroatom or a hydrocarbon group having 1-40 carbon atoms.

X' is a hydrocarbon group having 1-40 carbon atoms.

23. The transition metal compound as claimed in claim 22, wherein the radicals L are identical or different and are each a substituted cyclopentadienyl group.

24. The transition metal compound as claimed in claim 22, wherein the radicals L are linked to one another via a bridge.

25. The transition metal compound as claimed in claim 22, wherein n is 2 when M is a metal atom of group IVb of the Periodic Table of the Elements.

26. The transition metal compound as claimed in claim 22, wherein

M is a metal atom of group IVb of the Periodic Table of the Elements, n is equal to 2,

L are identical or different and are each a substituted cyclopentadienyl group, where two radicals L are optionally linked to one another via a bridge Z and

Z is CR^2R^3 or SiR^2R^3 or a unit $\text{Si}-(\text{CR}^2\text{R}^3)_x-\text{Si}$ which links two fragments $\text{L}_n\text{MXX}'\text{A-R}^1_m$ with one another, where x is an integer from 0 to 10.

X and X' together form a three-membered to five-membered hydrocarbon chain which can be saturated or unsaturated and are unsubstituted or substituted by one or more C₁-C₂₀-hydrocarbon radicals.

R² and R³ are identical or different and are each a hydrogen atom, a halogen atom, a C₁-C₂₀-alkyl group, a C₁-C₁₀-fluoralkyl group, a C₁-C₁₀-alkoxy group, a C₆-C₁₄-aryl group, a C₆-C₁₀-fluoroaryl group, a C₆-C₁₀-aryloxy group, a C₂-C₁₀-alkenyl group, a C₇-C₄₀-arylalkyl group, a C₇-C₄₀-alkylaryl group, a C₈-C₄₀-arylalkenyl group, or R² and R³ together with the atoms connected them form one or more rings, and R² and R³ are optionally bonded to L.

27. The transition metal compound as claimed in claim 22, wherein

M is zirconium,

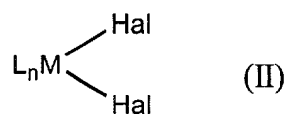
n is equal to 2,

L are identical or different and are each a substituted cyclopentadienyl group, where two radicals L are linked to one another via a bridge Z, where Z is CR²R³ or SiR²R³ and

R² and R³ are identical or different and are each a hydrogen atom, a halogen atom, a C₁-C₂₀-alkyl group, a C₁-C₁₀-fluoralkyl group, a C₁-C₁₀-alkoxy group, a C₆-C₁₄-aryl group, a C₆-C₁₀-fluoroaryl group, a C₆-C₁₀-aryloxy group, a C₂-C₁₀-alkenyl group, a C₇-C₄₀-arylalkyl group, a C₇-C₄₀-alkylaryl group, a C₈-C₄₀-arylalkenyl group, or R² and R³ together with the atoms connected them form one or more rings, and R² and R³ are optionally bonded to L.

X and X' together form an unsaturated four-membered hydrocarbon chain whose hydrogen atoms are optionally replaced by C₁-C₂₀-alkyl groups.

28. A process for preparing the compound as claimed in claim 22,
which comprises reacting a compound of the formula II

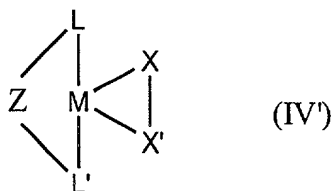


with a compound of the formula III



and reacting the reaction product with a compound of the formula AR_m¹, where L, n, M, X and X' in the formulae II and III are defined for the formula IV and Hal is a halogen atom.

29. A transition metal compound of the formula IV'



where

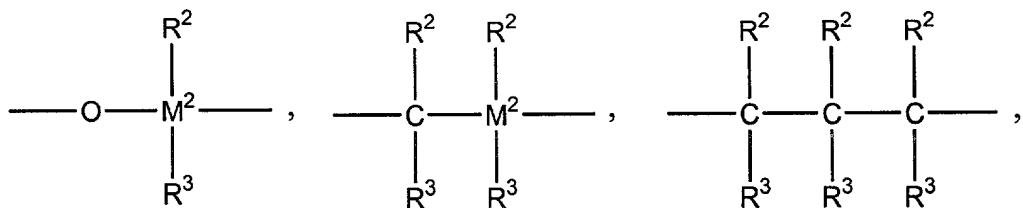
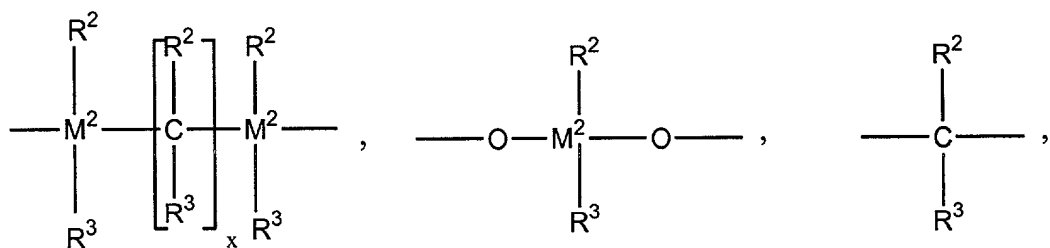
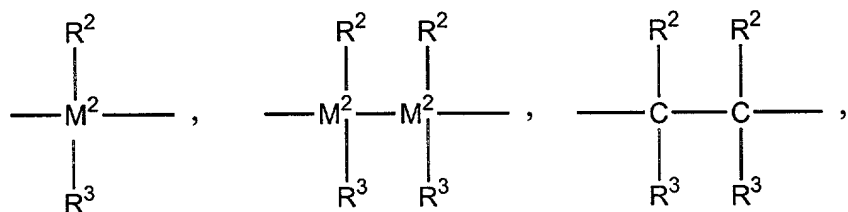
L and L' are identical or different and are each a π ligand or an electron donor.

M is a metal atom of group IIIb, IVb, Vb or VIb of the Periodic Table of the Elements.

X is a heteroatom or a hydrocarbon group having 1-40 carbon atoms.

X' is a hydrocarbon group having 1-40 carbon atoms.

Z is



=BR₂, -AlR², -Ge-, -O-, -S-, =SO, =SO₂, -NR₂, =CO, =PR² or =P(O)R², where R² and R³ are identical or different and are each a hydrogen atom, a halogen atom, a C₁-C₂₀-alkyl group, a C₁-C₁-fluoroalkyl group, a C₁-C₁₀-alkoxy group, a C₆-C₁₄-aryl group, a C₆-C₁₀-fluoroaryl group, a C₆-C₁₀-aryloxy group, a C₂-C₁₀-alkenyl group, a C₇-C₄₀-arylalkyl group, a C₇-C₄₀-alkylaryl group, a C₈-C₄₀-arylalkenyl group and x is a number from zero to 18, or R² and R³ together with the atoms-connecting them form one or more rings and R² or/and R³ can be bonded to L and M² is silicon, germanium or tin.

30. The transition metal compound as claimed in claim 29, wherein the radicals L are identical or different and are each an unsubstituted or substituted cyclopentadienyl group.

31. The transition metal compound as claimed in claim 29, wherein the radicals L are linked to one another via a bridge.

32. The transition metal compound as claimed in claim 29, wherein n is 2 when M is a metal atom of group IVb of the Periodic Table of the Elements.

33. The transition metal compound as claimed in claim 29, wherein
M is a metal atom of group IVb of the Periodic Table of the Elements, n is equal to 2,
L are identical or different and are each a substituted or unsubstituted cyclopentadienyl
group, where two radicals L are optionally linked to one another via a bridge Z and

Z is CR^2R^3 or SiR^2R^3 or a unit $\text{Si}-(\text{CR}^2\text{R}^3)_x-\text{Si}$ which links two fragments $\text{L}_n\text{M}^1\text{XX}'\text{A}-\text{R}_m^1$ with one another, where x is an integer from 0 to 10.

X and X' together form a three-membered to five-membered hydrocarbon chain which can be saturated or unsaturated and are unsubstituted or substituted by one or more $\text{C}_1\text{-C}_{20}$ -hydrocarbon radicals.

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a $\text{C}_1\text{-C}_{20}$ -alkyl group, a $\text{C}_1\text{-C}_{10}$ -fluoralkyl group, a $\text{C}_1\text{-C}_{10}$ -alkoxy group, a $\text{C}_6\text{-C}_{14}$ -aryl group, a $\text{C}_6\text{-C}_{10}$ -fluoroaryl group, a $\text{C}_6\text{-C}_{10}$ -aryloxy group, a $\text{C}_2\text{-C}_{10}$ -alkenyl group, a $\text{C}_7\text{-C}_{40}$ -arylalkyl group, a $\text{C}_7\text{-C}_{40}$ -alkylaryl group, a $\text{C}_8\text{-C}_{40}$ -arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L.

34. The transition metal compound as claimed in claim 29, wherein

M is zirconium.

n is 2.

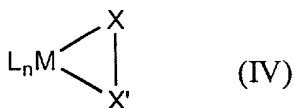
L are identical or different and are each a substituted cyclopentadienyl group, where two radicals L are linked to one another via a bridge Z, where Z is CR^2R^3 or SiR^2R^3 .

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a $\text{C}_1\text{-C}_{20}$ -alkyl group, a $\text{C}_1\text{-C}_{10}$ -fluoralkyl group, a $\text{C}_1\text{-C}_{10}$ -alkoxy group, a $\text{C}_6\text{-C}_{14}$ -aryl group, a $\text{C}_6\text{-C}_{10}$ -fluoroaryl group, a $\text{C}_6\text{-C}_{10}$ -aryloxy group, a $\text{C}_2\text{-C}_{10}$ -alkenyl group, a $\text{C}_7\text{-C}_{40}$ -arylalkyl group, a $\text{C}_7\text{-C}_{40}$ -

alkylaryl group, a C₈-C₄₀-arylalkenyl group, or R² and R³ together with the atoms connected them form one or more rings, and R² and R³ are optionally bonded to L.

X and X' together form an unsaturated four-membered hydrocarbon chain whose hydrogen atoms are optionally replaced by C₁-C₂₀-alkyl groups.

35. A transition metal compound of the formula IV



wherein

L are different if n is 2, 3 or 4, and are each a π ligand or electron donor.

n is equal to 1, 2, 3, or 4.

M is a metal atom of group IIIb, IVb, Vb or VIb of the Periodic Table of the Elements.

X is a heteroatom or a hydrocarbon group having 1-40 carbon atoms.

X' is a hydrocarbon group having 1-40 carbon atoms.

36. The transition metal compound as claimed in claim 35, wherein the radicals L are different and are each an unsubstituted or substituted cyclopentadienyl group.

37. The transition metal compound as claimed in claim 35, wherein the radicals L are linked to one another via a bridge.
38. The transition metal compound as claimed in claim 35, wherein n is 2 when M is a metal atom of group IVb of the Periodic Table of the Elements.
39. The transition metal compound as claimed in claim 35, wherein
M is a metal atom of group IVb of the Periodic Table of the Elements, n is equal to 2,
L are different and are each a substituted or unsubstituted cyclopentadienyl group, where two
radicals L are optionally linked to one another via a bridge Z and
Z is CR²R³ or SiR²R³ or a unit Si-(CR²R³)_x-Si which links two fragments L_nM'XX'A-R¹_m with
one another, where x is an integer from 0 to 10,
X and X' together form a three-membered to five-membered hydrocarbon chain which can
be saturated or unsaturated and are unsubstituted or substituted by one or more C₁-C₂₀-
hydrocarbon radicals,
R² and R³ are identical or different and are each a hydrogen atom, a halogen atom, a C₁-
C₂₀-alkyl group, a C₁-C₁₀-fluoralkyl group, a C₁-C₁₀-alkoxy group, a C₆-C₁₄-aryl group, a
C₆-C₁₀-fluoroaryl group, a C₆-C₁₀-aryloxy group, a C₂-C₁₀-alkenyl group, a C₇-C₄₀-arylalkyl
group, a C₇-C₄₀-alkylaryl group, a C₈-C₄₀-arylalkenyl group, or R² and R³ together with
the atoms connected them form one or more rings, and R² and R³ are optionally bonded
to L.

40. The transition metal compound as claimed in claim 35, wherein

M is zirconium,

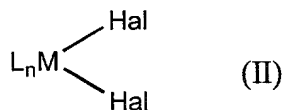
n is 2,

L are different and are each a substituted cyclopentadienyl group, where two radicals L are linked to one another via a bridge Z, where Z is CR²R³ or SiR²R³ and

R² and R³ are identical or different and are each a hydrogen atom, a halogen atom, a C₁-C₂₀-alkyl group, a C₁-C₁₀-fluoralkyl group, a C₁-C₁₀-alkoxy group, a C₆-C₁₄-aryl group, a C₆-C₁₀-fluoroaryl group, a C₆-C₁₀-aryloxy group, a C₂-C₁₀-alkenyl group, a C₇-C₄₀-arylalkyl group, a C₇-C₄₀-alkylaryl group, a C₈-C₄₀-arylalkenyl group, or R² and R³ together with the atoms connected them form one or more rings, and R² and R³ are optionally bonded to L.

X and X' together form an unsaturated four-membered hydrocarbon chain whose hydrogen atoms are optionally replaced by C₁-C₂₀-alkyl groups.

41. A process for preparing the compound as claimed in claim 35,
which comprises reacting a compound of the formula II



with a compound of the formula III

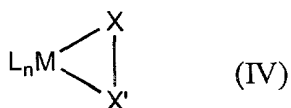


and reacting the reaction product with a compound of the formula AR_m^1 , where L, n, M, X and

X' in the formulae II and III are defined for the formula IV,

Hal is a halogen atom.

42. A transition metal compound of the formula IV



wherein

L are identical or different and are each a π ligand or electron donor,

n is equal to 1, 2, 3, or 4,

M is a metal atom of group IIb, IVb, Vb or VIb of the Periodic Table of the Elements,

X is a heteroatom, a $\text{C}_6\text{-C}_{14}$ -aryl group, a $\text{C}_7\text{-C}_{40}$ -arylalkyl group, a $\text{C}_7\text{-C}_{40}$ -alkylaryl group or a $\text{C}_8\text{-C}_{40}$ -arylalkenyl group,

X' or a hydrocarbon group having 1-40 carbon atoms.

43. The transition metal compound as claimed in claim 42, wherein the radicals L are different and are each an unsubstituted or substituted cyclopentadienyl group.
44. The transition metal compound as claimed in claim 42, wherein the radicals L are linked to one another via a bridge.
45. The transition metal compound as claimed in claim 42, wherein n is 2 when M is a metal atom of group IVb of the Periodic Table of the Elements.
46. The transition metal compound as claimed in claim 42, wherein
M is a metal atom of group IVb of the Periodic Table of the Elements, n is equal to 2,
L are different and are each a substituted or unsubstituted cyclopentadienyl group, where two
radicals L are optionally linked to one another via a bridge Z and
Z is CR²R³ or SiR²R³ or a unit Si-(CR²R³)_x-Si which links two fragments L_nM'XX'A-R¹_m with
one another, where x is an integer from 0 to 10.
X and X' together form a three-membered or five-membered hydrocarbon chain which can
be saturated or unsaturated and are unsubstituted or substituted by one or more C₁-C₂₀-
hydrocarbon radicals.
R² and R³ are identical or different and are each a hydrogen atom, a halogen atom, a C₁-
C₂₀-alkyl group, a C₁-C₁₀-fluoralkyl group, a C₁-C₁₀-alkoxy group, a C₆-C₁₄-aryl group, a
C₆-C₁₀-fluoroaryl group, a C₆-C₁₀-aryloxy group, a C₂-C₁₀-alkenyl group, a C₇-C₄₀-arylalkyl

group, a C₇-C₄₀-alkylaryl group, a C₈-C₄₀-arylalkenyl group, or R² and R³ together with the atoms connected them form one or more rings, and R² and R³ are optionally bonded to L.

47. The transition metal compound as claimed in claim 42, wherein

M is zirconium,

n is 2,

L are different and are each a substituted cyclopentadienyl group, where two radicals L are linked to one another via a bridge Z, where Z is CR²R³ or SiR²R³ and

R² and R³ are identical or different and are each a hydrogen atom, a halogen atom, a C₁-C₂₀-alkyl group, a C₁-C₁₀-fluoralkyl group, a C₁-C₁₀-alkoxy group, a C₆-C₁₄-aryl group, a C₆-C₁₀-fluoroaryl group, a C₆-C₁₀-aryloxy group, a C₂-C₁₀-alkenyl group, a C₇-C₄₀-arylalkyl group, a C₇-C₄₀-alkylaryl group, a C₈-C₄₀-arylalkenyl group, or R² and R³ together with the atoms connected them form one or more rings, and R² and R³ are optionally bonded to L.

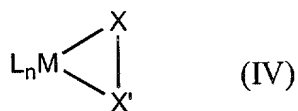
48. A compound selected from the group consisting of

Bis (methylcyclopentadienyl) ZrCH₂CHCHCH₂;
Bis (n-butyl-cyclopentadienyl) ZrCH₂CHCHCH₂;
BisindenylZrCH₂CHCHCH₂;
(tert.butylamido)dimethyl (tetramethyl- η^5 -cyclopentadienyl) si-
lan-Zr⁺CH₂CHCHCH₂;
Bis (2-methylbenzoindenyl) ZrCH₂CHCHCH₂;
Dimethylsilandiylbis (2-methyl-indenyl) ZrCH₂CHCHCH₂;
DimethylsilandiylbisindenylZr⁺CH₂CHCHCH₂;
Dimethylsilandiylbis (2-methylbenzoindenyl) ZrCH₂CHCHCH₂;
Dimethylsilandiyl (2-methylbenzoindenyl) (2-methyl-indenyl)
ZrCH₂CHCHCH₂;
Dimethylsilandiyl (2-methylbenzoindenyl) (2-methyl-4-phenylindenyl)
ZrCH₂CHCHCH₂ ;
Dimethylsilandiyl (2-methylindenyl) (4-phenylindenyl) ZrCH₂CHCHCH₂;
Dimethylsilandiylbis (2-methyl-4-phenyl-indenyl) ZrCH₂CHCHCH₂;
Dimethylsilandiylbis (2-methyl-4,6-diisopropyl-indenyl) Zr⁺
CH₂CHCHCH₂;
Dimethylsilaniylbis (2-methyl-4-naphtyl-indenyl) ZrCH₂CHCHCH₂;
Isopropyliden (cyclopentadienyl) (fluorenyl) ZrCH₂CHCHCH₂;
Isopropyliden (cyclopentadienyl) (indenyl) ZrCH₂CHCHCH₂;
[4- (η^5 -Cyclopentadienyl) -4,7,7-trimethyl- (η^5 -4.5.6.7-tetrahydro-
indenyl) ZrCH₂CHCHCH₂;
Dimethylsilandiylbis (2-methyl-indenyl) ZrOCH₂CH₂CH₂;
DimethylsilandiylbisindenylZrOCH₂CH₂CH₂;
Dimethylsilandiylbis (2-methylbenzoindenyl) ZrOCH₂CH₂CH₂;
Dimethylsilandiyl (2-methylbenzoindenyl) (2-methyl-indenyl)
ZrOCH₂CH₂CH₂;
Dimethylsilandiyl (2-methylbenzoindenyl) (2-methyl-4-phenylindenyl)
ZrOCH₂CH₂CH₂;
Dimethylsilandiyl (2-methylindenyl) (4-phenylindenyl) ZrOCH₂CH₂CH₂;
Dimethylsilandiylbis (2-methyl-4-phenyl-indenyl) ZrOCH₂CH₂CH₂;
Dimethylsilandiylbis (2-methyl-4,6-diisopropyl-indenyl)
ZrOCH₂CH₂CH₂;
Dimethylsilandiylbis (2-methyl-indenyl) ZrCH₂C (CH₃) C (CH₃) CH₂;
DimethylsilandiylbisindenylZrCH₂C (CH₃) C (CH₃) CH₂;
Dimethylsilandiylbis (2-methylbenzoindenyl) Zr⁺CH₂C (CH₃) C (CH₃) CH₂;
Dimethylsilandiyl (2-methylbenzoindenyl) (2-methyl-indenyl)
ZrCH₂C (CH₃) C (CH₃) CH₂;
Dimethylsilandiyl (2-methylbenzoindenyl) (2-methyl-4-phenylindenyl)
ZrCH₂C (CH₃) C (CH₃) CH₂;

Dimethylsilandiyl (2-methylindenyl) (4-phenylindenyl)
ZrCH₂C(CH₃)C(CH₃)CH₂;
Dimethylsilandiylbis (2-methyl-4-phenyl-indenyl)
ZrCH₂C(CH₃)C(CH₃)CH₂;
Dimethylsilandiylbis (2-methyl-4,6-diisopropyl-indenyl)
ZrCH₂C(CH₃)C(CH₃)CH₂;
Dimethylsilandiylbis (2-methyl-4-naphtyl-indenyl)
ZrCH₂C(CH₃)C(CH₃)CH₂;
Methylphenylmethylen- (fluorenyl) (cyclopentadienyl) ZrCH₂CHCHCH₂;
Diphenylmethylen- (fluorenyl) (cyclopentadienyl) ZrCH₂CHCHCH₂;
Isopropyliden- (3-methylcyclopentadienyl) (fluorenyl)
ZrCH₂CHCHCH₂B⁻(C₆F₅)₃;
Dimethylsilandiyl- (3-tert.-Butylcyclopentadienyl) (fluorenyl)
ZrCH₂CHCHCH₂;
Diphenylsilandiyl- (3-(trimethylsilyl)cyclopentadienyl) (fluorenyl)
ZrCH₂CHCHCH₂;
Phenylmethylsilandiylbis (e-methyl-indenyl) ZrCH₂CHCHCH₂;
Phenylmethylsilandiylbisindenyl ZrCH₂CHCHCH₂;
Phenylmethylsilandiylbis (2-methyl-4,5-benzoindenyl) ZrCH₂CHCHCH₂;
Phenylmethylsilandiylbis (2-methyl-4,5-benzoindenyl) (2-methyl
-indenyl) ZrCH₂CHCHCH₂;
Phenylmethylsilandiyl (2-methyl-4,5-benzoindenyl) (2-methyl-4
-phenylindenyl) ZrCH₂CHCHCH₂;
Phenylmethylsilandiyl (2-methylindenyl) (4-phenylindenyl)
ZrCH₂CHCHCH₂;
Phenylmethylsilandiylbis (2-methyl-4-phenyl-indenyl) ZrCH₂CHCHCH₂;
Phenylmethylsilandiylbis (2-ethyl-4-phenyl-indenyl) ZrCH₂CHCHCH₂;
Phenylmethylsilandiylbis (2-methyl-4,6-diisopropyl-indenyl)
ZrCH₂CHCHCH₂;
Phenylmethylsilandiylbis (2-methyl-4-naphtyl-indenyl) ZrCH₂CHCHCH₂;
Ethylenbis (2-methyl-indenyl) ZrCH₂CHCHCH₂;
Ethylenbisindenyl ZrCH₂CHCHCH₂;
Ethylenbis (2-methyl-4,5-benzoindenyl) ZrCH₂CHCHCH₂;
Ethylen (2-methyl-4,5-benzoindenyl) (2-methyl-indenyl) ZrCH₂CHCHCH₂;
Ethylen (2-methyl-4,5-benzoindenyl) (2-methyl-4-phenylindenyl)
ZrCH₂CHCHCH₂;
Ethylen (2-methylindenyl) (4-phenylindenyl) ZrCH₂CHCHCH₂;
Ethylenbis (2-methyl-4,5-benzoindenyl) ZrCH₂CHCHCH₂;
Ethylenbis (2-methyl-4-phenyl-indenyl) ZrCH₂CHCHCH₂;
Ethylenbis (2-methyl-4,6-diisopropyl-indenyl) ZrCH₂CHCHCH₂;

Ethylenbis (2-methyl-4-naphtyl-indenyl) ZrCH₂CHCHCH₂;
Ethylenbis (2-ethyl-4-phenyl-indenyl) ZrCH₂CHCHCH₂;
Ethylenbis (2-ethyl-4,6-diisopropyl-indenyl) ZrCH₂CHCHCH₂;
Ethylenbis (2-ethyl-4-naphtyl-indenyl) ZrCH₂CHCHCH₂;
Dimethylsilandiylbis (2-ethyl-4-phenyl-indenyl) ZrCH₂CHCHCH₂;
Dimethylsilandiylbis (2,3,5-trimethylcyclopentadienyl)
ZrCH₂CHCHCH₂;
1,6-{Bis [methylsilyl-bis (2-methyl-4-phenyl-indenyl) Zr+CH₂CHCHCH₂
B⁻ (C₆F₅)₃] } hexan;
1,6-{Bis [methylsilyl-bis (2-ethyl-4-phenyl-indenyl)
Zr+CH₂CHCHCH₂B⁻ (C₆F₅)₃] } hexan;
1,6-{Bis [methylsilyl-bis (2-methyl-4-naphtyl-indenyl) Zr+CH₂CHCHCH₂
B⁻ (C₆F₅)₃] } hexan;
1,6-{Bis [methylsilyl-bis (2-methyl-4,5-benzoindenyl) Zr⁺CH₂CHCHCH₂
B⁻ (C₆F₅)₃] } hexan;
1,6-{Bis [methylsilyl- (2-methyl-4-phenyl-indenyl) (2-methyl-inde-
nyl) Zr⁺CH₂CHCHCH₂B⁻ (C₆F₅)₃] } hexan;
1,2-{Bis [methylsilyl-bis (2-methyl-4-phenyl-indenyl) Zr⁺CH₂CHCHCH₂
B⁻ (C₆F₅)₃] } ethan;
1,2-{Bis [methylsilyl-bis (2-ethyl-4-phenyl-indenyl) Zr⁺CH₂CHCHCH₂
B⁻ (C₆F₅)₃] } ethan;
1,2-{Bis [methylsilyl-bis (2-methyl-4-naphtyl-indenyl) Zr⁺CH₂CHCHCH₂
B⁻ (C₆F₅)₃] } ethan;
1,2-{Bis [methylsilyl-bis (2-methyl-4,5-benzoindenyl) Zr⁺CH₂CHCHCH₂
B⁻ (C₆F₅)₃] } ethan; and
1,2-{Bis [methylsilyl- (2-methyl-4-phenyl-indenyl) (2-methyl-inde-
nyl) Zr⁺CH₂CHCHCH₂B⁻ (C₆F₅)₃] } ethan.

49. A transition metal compound of the formula IV



wherein

L are identical or different and are each a π ligand or electron donor,

n is equal to 1, 2, 3, or 4,

M is a metal atom of group IIIb, IVb, Vb or VIb of the Periodic Table of the Elements,

X is a heteroatom or a hydrocarbon group having 1-40 carbon atoms,

X' is a hydrocarbon group having 1-40 carbon atoms,

with the proviso that at least one L is a substituted or unsubstituted indenyl.

50. The transition metal compound as claimed in claim 49, wherein the radicals L are linked to one another via a bridge.

51. The transition metal compound as claimed in claim 49, wherein n is 2 when M is a metal atom of group IVb of the Periodic Table of the Elements.

52. The transition metal compound as claimed in claim 49, wherein

M is a metal atom of group IVb of the Periodic Table of the Elements, n is equal to 2, where two radicals L are optionally linked to one another via a bridge Z and

Z is CR^2R^3 or SiR^2R^3 or a unit $\text{Si}-(\text{CR}^2\text{R}^3)_x-\text{Si}$ which links two fragments $\text{L}_u\text{M}'\text{XX}'\text{A}-\text{R}_m^1$ with one another, where x is an integer from 0 to 10,

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a $\text{C}_1\text{-C}_{20}$ -alkyl group, a $\text{C}_1\text{-C}_{10}$ -fluoralkyl group, a $\text{C}_1\text{-C}_{10}$ -alkoxy group, a $\text{C}_6\text{-C}_{14}$ -aryl group, a $\text{C}_6\text{-C}_{10}$ -fluoroaryl group, a $\text{C}_6\text{-C}_{10}$ -aryloxy group, a $\text{C}_2\text{-C}_{10}$ -alkenyl group, a $\text{C}_7\text{-C}_{40}$ -arylalkyl group, a $\text{C}_7\text{-C}_{40}$ -alkylaryl group, a $\text{C}_8\text{-C}_{40}$ -arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L.

53. The transition metal compound as claimed in claim 49, wherein

M is zirconium,

n is 2,

where two radicals L are linked to one another via a bridge Z, wherein

Z is CR^2R^3 or SiR^2R^3 and

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a $\text{C}_1\text{-C}_{20}$ -alkyl group, a $\text{C}_1\text{-C}_{10}$ -fluoralkyl group, a $\text{C}_1\text{-C}_{10}$ -alkoxy group, a $\text{C}_6\text{-C}_{14}$ -aryl group, a $\text{C}_6\text{-C}_{10}$ -fluoroaryl group, a $\text{C}_6\text{-C}_{10}$ -aryloxy group, a $\text{C}_2\text{-C}_{10}$ -alkenyl group, a $\text{C}_7\text{-C}_{40}$ -arylalkyl group, a $\text{C}_7\text{-C}_{40}$ -alkylaryl group, a $\text{C}_8\text{-C}_{40}$ -arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L. - -

REMARKS

The applicants respectfully request reconsideration in view of the following remarks. Support for the newly added claims 22-53 can be found at col. 7 and the examples. The applicants are claiming the intermediates of formula IV and the process to make these intermediates. The applicants have added claims 22-53 which inadvertently were not claimed in US Patent 6,002,032. Independent claim 22 is directed to a transitional metal compound having substituted π ligand(s). Independent claim 29 is directed to a bridge transition metal compound. Independent claim 35 is directed to transition metal compound where L is different when n is 2, 3 or 4. Independent claim 42 is directed to a transition metal compound where X is a heteroatom or an aromatic group. Claim 48 is drawn to specific species. Independent claim 49 is directed to a metal compound having at least one L as a substituted or unsubstituted indenyl ligand.

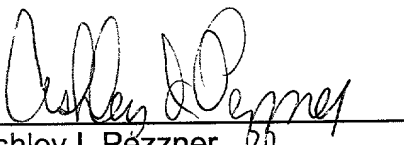
The applicants have also enclosed three additional references from Dow Chemical Company which all claim priority to the same application.

If there are any additional fees due in connection with the filing of this response, including any fees required for an additional extension of time under 37 CFR 1.136, such an extension is requested and the Commissioner is authorized to charge any debit or credit

any overpayment to Deposit Account No. 03-2775. A prompt and favorable action is earnestly solicited.

Respectfully submitted,

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